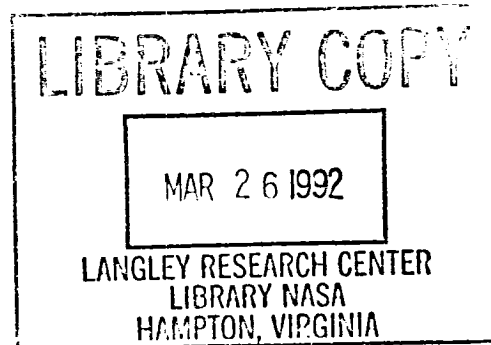


Unification: An International Aerospace Information Issue

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Abstract

Scientific and Technical Information (STI) represents the results of large investments in research and development (R&D) and the expertise of a nation and is a valuable resource. For more than four decades, NASA and its predecessor organizations have developed and managed the preeminent aerospace information system. NASA obtains foreign materials through its international exchange relationships, continually increasing the comprehensiveness of the NASA Aerospace Database (NAD). The NAD is de facto the international aerospace database. For the past few years, a number of changes have occurred in the aerospace industry as well as with information technology. Science and technology projects are becoming more and more international. Other parts of the world, notably Europe, are increasingly powerful players in the aerospace business. This change has led to the development of various aerospace information initiatives in other countries. With scarce resources in all areas of government and industry, the NASA STI Program is reviewing its exchange program policies to factor in the changing requirements within the international community. This paper reviews current NASA goals and activities with a view toward maintaining compatibility among international aerospace information systems, eliminating duplication of effort, and sharing resources through international cooperation wherever possible.

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Introduction

The history of international aerospace information system development has paralleled that of national aerospace research and development (R&D) programs. The U.S., a major and early entrant into aerospace R&D, created a national focus in the National Advisory Committee on Aeronautics (NACA) in 1915 when the early library system made extensive efforts to acquire documents from worldwide sources that related to NACA programs. NACA was followed by the creation of the National Aeronautics and Space Administration (NASA) in 1958. From NASA's conception the need for and role of a centralized scientific and technical information system was recognized. NASA's enabling legislation requires NASA to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." The international nature of the mission was also recognized in the directive for NASA to conduct its activities "so as to continue to contribute materially to ... cooperation by the United States with other nations and groups of nations in work pursuant to the Act and in the peaceful application of the results thereof." The result of this major U.S. R&D mission and the creation of an integral scientific and technical information (STI) mission led to the early commitment and continued development of a NASA STI Program and a NASA international aerospace database.

As the programs of other nations grew, particularly in Europe with the creation of the European Space Agency (ESA), NASA found a natural partner for cooperation in both its technical and its information programs. NASA expanded the development of its database input to include resources provided by ESA. More recently in Europe, and consistent with joint R&D programs and a view toward a United Europe, we have seen the emergence of a European Aerospace Database (EAD) concept.

Today, in addition to the ESA programs, the development of aeronautics and astronautics in individual nations has also led to initiatives (in various degrees of development) of national databases such as the German Aeronautics and Astronautics Database - Deutsche Luft-und Raumfahrt Datenbank (DELURA) Initiative and now the seminal idea for a Japanese aerospace database called the Japanese Aerospace Information Reference System (AIRS).

Considering both the technological developments in information and technology and the realities of scarce resources for every nation, NASA STI Program management believes it is time for a reconsideration of cooperation and international resource sharing. As part of the NASA STI Program's current long-range planning initiative, its management is looking closely at its international exchange programs. The types of feedback the NASA STI Program management has been receiving, including the statements made at the European Forum on Information and Documentation held in Strasbourg in January 1990 by representatives of a major German exchange partner, clearly indicate that there is a desire for international cooperation and a need for program flexibility and change. NASA, in cooperation with ESA, is undertaking a major survey to explore exactly what the issues and opportunities are for the future of information exchanges.

This paper poses some ideas about where to go from here. It raises for consideration new possibilities for unification of the various aerospace database efforts toward a cooperative international aerospace database initiative that can optimize the cost/benefit equation for all participants.

The NASA Aerospace Database

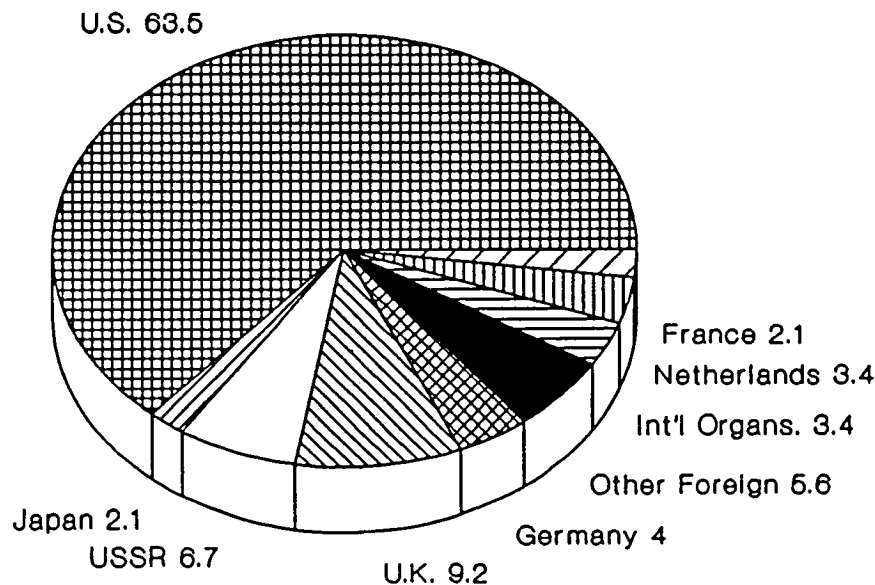
The mission of the NASA STI Program as it is stated today is "acquire and disseminate STI to advance aerospace knowledge, and support NASA goals." The focus of the effort is the development of a global program to encourage the creation and exchange of STI and facilitate its use. One of the critical foundations of this

program is the NASA Aerospace Database which contains bibliographic citations to international aerospace literature.

Today, the NAD contains 2,252,000 research summaries covering 1962 to the present. Approximately 27 percent of the NAD provides intelligence on foreign R&D results originally published abroad. In fact, the percentage of foreign material is increasing. This is a result of better acquisition processes as well as an increased proportion of the knowledge base being developed abroad. In 1990, 36 percent (25,000 out of 69,000 records) of the world's literature on aerospace as reflected in NAD came from abroad. Figure 1 provides a further breakdown of these numbers by major geographic areas of interest. Of the foreign material, more than 10 percent of the original documents are written in languages other than English. The fact that the NAD has English language summaries of all of these research publications is an extremely helpful aid in determining basic facts about the existence and nature of this R&D. Of the current annual input to NAD, more than 5,700 documents were received in 1990 through international exchange agreements directly with the NASA STI Program. Of these only 56 percent have citations that are processed abroad. This means that NASA currently pays for the bibliographic processing in English of the remaining foreign documents. Because the new basis of exchange calls for the provision of English language citations in NASA format, NASA acquisitions and processing dollars will be freed to increase NAD's comprehensiveness. This new policy also encourages commitment, communication, and more active involvement of international partners because of the professional efforts involved.

Although the NAD has served as the de facto international aerospace database, the NASA STI international community policies which were developed in the 1970s have not evolved as information technology and national aerospace initiatives changed the complexion

**FIGURE 1. Percent of R&D Summaries
in the NASA Aerospace Database, By
Country for 1990 Input**



of international aerospace STI. As a result, the system has become dysfunctional for some nations and they are seeking new solutions and often new systems to satisfy their needs.

International Reactions to the Current NASA Aerospace Information Policies

There are several ways to determine reactions to the way the NASA STI Program has been operating in the international arena. One is to observe what other countries are doing and another is to survey them and ask directly. The following sections summarize input that NASA STI Program management is using in strategic planning for its international information programs. They give two European reactions to the type of tripartite arrangements that have been the primary

source of foreign exchange material. We then briefly describe the Japanese reaction to the newest approach NASA is using for international exchanges. This approach is based on a nation-to-nation exchange protocol between NASA and the governmental organization with aerospace responsibility in the other country. The protocols call for the NASA counterpart organization to act as the coordinator for the exchange of information between NASA and that country. Specifically, in exchange for the foreign country's information provided in English in specified formats compatible with the NASA information processing system, the partner receives access to the NAD. Then we discuss the results of a direct survey that NASA and ESA conducted jointly regarding the Tripartite Exchange Program.

European Initiatives

It was mentioned previously that other nations and the European community (through ESA) have recognized the value of their own national literature and its effective management. The DELURA initiative in Germany is based on voluntary cooperation between government and industry to collect the nation's aerospace information. The DELURA governing board is presently under the chairmanship of BDLI (Bundesverband der Deutschen Luftfahrt-Raumfahrt- und Ausrüstungsindustrie), the German Aerospace Industries Association. The operating agent for the enterprise is the Fachinformationszentrum (FIZ4), Karlsruhe. The objectives of the effort are to create a comprehensive national aerospace bibliographic database to document German knowhow, complement NAD, form a basis for bilateral cooperation, and form the basis for European cooperation.

Initially, the Germans expect to input 3000 items per year to DELURA, and plan to increase this amount to 5000 per year. It was estimated that East Germany might total 10 percent of this number. Today NASA receives about 2500 items from Germany to add to the database annually. The implication of the German initiative is that through effective nation-to-nation cooperation and the exchange of DELURA information for NAD information, the U.S. could increase its comprehensive access to German R&D results by more than 100 percent. In addition, processing costs for cataloging, abstracting, and indexing a majority of that information will no longer be a NASA expense.

In the case of the European Aerospace Database (EAD), founded by ESA, there is another interesting set of objectives and implications. The stated motivation for the creation of EAD was said to reflect the growth of European space programs during the second half of the 1980s. This growth caused the proliferation of documents generated by Europe and its industry. EAD was seen as a database whose content and accessibility would be completely under ESA's control.

The major features or unique aspects of the

EAD as its producers have defined them ¹ are as follows:

- References to both "unrestricted" and "restricted distribution" documents generated by ESA programs and the industry are in a single file.
- Through this control all references are visible online to the users, but the physical distribution of the original documents themselves can be limited as required by the multifaceted nature of the data generated by ESA and the industry.

EAD was made available online in 1990 after a few years of development under ESA's auspices. One initial concept for EAD, which was promoted by the Germans and the Dutch, was to have countries rather than individual institutions participate in a multi-lateral arrangement. Each nation would collect, catalog and contribute its national literature in exchange for access to literature of other nations. (This is similar to the NASA nation-to-nation protocol discussed below.) According to the Germans ², this concept was pushed because NASA imposed certain limitations on scope, timeliness, and use of the database that needed to be overcome for the European countries to have the access they needed to their own national literature as well as that of other countries. In addition, ESA added the consideration that there were certain documents that should be limited to the European community. These should be put under bibliographic control for that community's use, but not necessarily made available elsewhere. The EAD has not evolved as originally anticipated. The modus operandi has been an institution-by-institution arrangement with ESA rather than a national-government-sanctioned arrangement. The contents of the database is still primarily, if not almost entirely, the same input as included by ESA into the NAD. This has led to questions by Europeans and by NASA about the value of a separate European

database system. NASA is interested in ideas for modifying its current system to satisfy the needs of the Europeans within the context of the system currently supported by NASA. This means that NASA together with its international partners will need to rethink some of the database selection, processing, and access policies. The tripartite survey is part of the effort to understand these requirements.

Japanese Aerospace Database

Over the past few years, NASA has been negotiating with the National Aerospace Development Agency (NASDA) in Japan for an exchange of STI. Consistent with the NASA approach to have a country collect the literature produced within its borders, process a bibliographic record in a NASA-compatible format, and provide a full text copy of all gray literature items in exchange for access to the NAD and copies of NASA documents, NASDA has decided to implement a Japanese Aerospace Information Reference System (AIRS). AIRS will be the focal point for organizing the Japanese exchange contribution to NASA. It is in many respects similar to the DELURA concept in Germany. It is expected that NASDA will collect 1000 reports annually for exchange. This is almost three times the number that NASA collected and processed at its own expense during 1990. Although every country has special considerations in implementing a technical protocol, the approach taken so far by NASDA in Japan is an ideal model for a quid pro quo exchange. The formal agreement is still in the negotiations phase but both parties are very positive about the progress.

Preliminary Results of the NASA/ESA Tripartite Survey of Exchange Participants

NASA has official tripartite agreements with 526 institutions in 16 countries. The countries are the 13 European ESA member states (Austria, Belgium, Denmark, France, Germany, Ireland, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom) plus Finland, Portugal and Morocco. The basis of

the tripartite arrangement is that an institution receives the rights to commercially access the NAD via ESA's Information Retrieval System (ESA/IRS) in exchange for submitting technical documents for inclusion in the NAD. The rate of exchange as established in the agreement has been one search hour for each technical report. ESA abstracts and indexes the reports received from these organizations in English in NASA format as part of the exchange agreement.

During July 1991, questionnaires were sent to all of these organizations to determine their views on the current exchange arrangements and to solicit ideas for opportunities to improve or expand cooperative relationships. Questionnaires from 13 countries have been returned to date. The responses give indications of values associated with the exchange and point out some opportunities for improving the system.

Many of the participating institutions have perpetuated the relationship because of the value of on-line access to the NAD. It is apparent from the responses that the relationship has not always been viewed as an active partnership, but rather a simple marketplace exchange relationship. This was the view encouraged by NASA policy. In fact, on many of the questions about the program where a checklist of responses was provided, the "don't know" category received large numbers. On the question whether, in general, the respondent found the program to be a valuable one, almost half of the respondents "didn't know." Of those that did, however, all but two found the program valuable. This leaves a lot of room for mobilizing interest and a number of issues for NASA STI Program policy consideration. Although the earlier lack of European involvement was consistent with the requirement of the NASA approach at the time, today, the NASA STI Program management team is attempting to change the relationship to obtain more active international partnership and commitment.

Most respondents felt that all of their institutions R&D reports were not comprehensively included in the NAD. However, the majority also felt that

items did appear in the NAD in a timely manner. An overwhelming majority of respondents felt that the current subject scope of the NAD adequately covered their needs in aerospace science and technology. For those that disagreed, the following subjects were suggested as missing: airports air traffic, regional and operational air traffic problems, military aircraft equipment, history of aeronautics/astronautics, air transport economics and politics, airline management, ecology (not only environmental pollution), and national and international space policy. The emphasis on requirements for operational aviation data is interesting and may lead to some exploratory discussions on the relationship between NASA R&D information and that more closely associated with the Federal Aviation Administration.

New Opportunities Identified

A number of questions were designed to solicit ideas about how to improve the program and promote more international involvement and participation. Some of the specific questions were based on ideas that had already been suggested by participating organizations through personal contact. In answer to a question regarding the creation of a Users' Council, the data indicated considerable interest in creating one, with the highest interest at the European level. Both the international and national level were of some, but less interest.

There was considerable interest in developing a common and comprehensive International Aerospace Database. Thoughts on how to develop such a system included the following:

- Combine the NASA and ESA (EAD) files
- Increase coverage of the Soviet Union and Japan
- Encourage cooperation with national information centers

Throughout the answers to open ended questions, people made suggestions about expanding the international coverage outside of

Europe. Of greatest interest was increased coverage of Soviet and Japanese literature.

In addition to improving the bibliographic coverage, a number of organizations suggested sharing other types of STI. The types of STI suggested for sharing included databanks, especially those with experimental data; factual databases; research in progress, directories, material property databases; engineering drawings; and even "databases for molecular properties for radiative transfer in atmospheres."

Where Do We Go From Here?

If we look at the three international database efforts discussed above as leading examples, as well as the data from the recent Tripartite Survey, we see that there are significant issues that need reconsideration in light of scarce resources and an increasing trend toward international cooperation. The NASA STI Program has undertaken a major strategic planning effort to consider how to move toward a truly international cooperative enterprise. The objective is primarily to make the database a more comprehensive and timely tool for U.S. researchers. In addition, if other nations begin to bear a larger share of the burden of keeping the database up to date, then the NASA STI Program can allocate its scarce acquisition and processing resources to covering areas of the world that cannot now be covered through cooperative efforts.

Finally, from the survey, the NASA STI Program now has a better understanding of foreign goals and objectives for participating in the existing international information exchange. The NASA STI Program has a top priority direction from its STI Council, composed of senior representatives from the major NASA programs, to increase international coverage in the database. The Council feels that the coverage of foreign literature is nowhere near comprehensive and is not sufficient.

NASA can begin to understand a number of things from listening to its foreign partners. Information has become a valuable resource.

Evidence includes ESA's creation of a separate, but largely duplicative system so that they have control. Consider the German Initiative, one of whose objectives is to use its DELURA database as an item for cooperation or exchange. NASA's arrangement for quid pro quo or reciprocity has always been difficult to define because NASA is exchanging the knowledge base of the largest funder of aerospace R&D with other nations ranging from those with highly developed aerospace programs to those with rather small resource commitments. However, it is clear that a lot of progress can be made by listening to needs and making some policy and operational changes to the historical way of doing business. If NASA can better coordinate the relationships with the three developing activities described here, database coverage can be more comprehensive in the European and Japanese areas and some resources can be reallocated to pursuing acquisitions in other areas. Once the pattern is established, negotiations with other countries will probably be easier. If compatible standards can be established in early stages through such agreements, the aerospace community will save resources by not reworking information for exchange. In the end, NASA hopes to follow the pattern of international cooperation in science projects with a cooperatively developed truly International Aerospace Database.

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